

STS 122 Return Samples: Assessment of Air Quality aboard the Shuttle (STS-122) and International Space Station (1E)

The toxicological assessments of 2 grab sample canisters (GSCs) from the Shuttle are reported in Table 1. Formaldehyde badges were not used. Analytical methods have not changed from earlier reports. The recoveries of the 3 surrogates (¹³C-acetone, fluorobenzene, and chlorobenzene) from the 2 GSCs averaged 100, 107, and 108%, respectively. The Shuttle atmosphere was acceptable for human respiration.

Table 1. Analytical Summary of Shuttle Samples

Sample Location	Date of Sample	NMVOCs ^a (mg/m ³)	T Value ^b (units)	Alcohols (mg/m ³)	Formaldehyde (µg/m ³)
Flight deck (preflight)	2/7/08	0.2	0.02	0.1	--
Middeck (end mission)	2/20/08	3.1	0.49	0.9	--

^a Non-methane volatile organic hydrocarbons.

^b Calculated excluding CO₂, formaldehyde, and siloxanes.

The toxicological assessment of 10 GSCs from the ISS is shown in Table 2. Ten pairs of formaldehyde badges were also returned. The recoveries of the 3 control formaldehyde badges averaged 98% and the recoveries from the 3 standards (as listed above) from the GSCs averaged 100, 95 and 97%, respectively.

Table 2. Analytical Summary of ISS Results (previously reported values are in gray)

Module/Sample	Approx. Date	NMVOCs ^a (mg/m ³)	T Value ^b (units)	Alcohols (mg/m ³)	Formaldehyde (µg/m ³)
Lab	9/04/07	4.1	0.57	3.0	32
SM	9/04/07	4.3	0.61	3.1	24
Lab	10/10/07	--	--	--	38
SM	10/10/07	5.3	0.55	4.4	24
Lab	11/12/07	5.8	0.72	4.5	40
SM	11/12/07	6.4	0.74	5.1	32
FGB	11/12/07	6.8	0.82	5.6	--
SM	12/07/07	5.2	0.73	4.0	45
Lab	12/07/07	5.2	0.74	4.0	30
Progress 27	12/26/07	60	2.48	42	--
Lab	1/11/08	6.6	0.95	4.4	41
FGB	1/11/08	6.1	0.75	4.5	--
SM	1/11/08	5.9	0.71	4.4	31
Columbus	2/12/08	15	2.14	8.3	--
<i>Guideline</i>		<25	<1.0	<5	<120

^a Non-methane volatile organic hydrocarbons.

^b Calculated excluding CO₂, formaldehyde, and siloxanes.

Based on these limited samples, the nominal ISS atmosphere is acceptable for human respiration. The nominal alcohol levels were well controlled throughout the period of sampling. Two first-entry samples, Progress 27 and Columbus, were analyzed. Both showed substantial pollution levels; however, the Progress 27 sample contained a remarkable level of pollution, even though it appears, based on CO₂ levels, that the

sample had been partially mixed with nominal ISS air. The T-value of the Progress sample was primarily increased due to a small amount of furan, which we typically do not see in ISS samples. The increase in alcohols and NMVOCs in Progress was primarily due to high concentrations of ethanol (36 mg/m³) and acetone (3.8 mg/m³). Ethyl and butyl acetates, C7-alkanes, toluene and xylenes were also markedly increased. The Columbus sample showed unusually high levels of trimethylsilanol (4.2 mg/m³) and 2-butanone (0.45 mg/m³), which were the major pollutants found in the ground-based offgas test of the module in November 2006. Inspection of the air quality parameters before and after the arrival of a new module (in this case Progress 27) demonstrates that the air revitalization systems are fully capable of maintaining a steady-state condition despite the additional pollution loads.

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Enclosures

[Table 1A: Analytical concentrations of compounds found in the STS-122 GSCs](#)

[Table 1B: Analytical concentrations of compounds found in 1E GSCs](#)

[Table 2A: T-values of the compounds in table 1A](#)

[Table 2B: T-values of the compounds in table 1B](#)